

DISPLAY PANEL AND DISPLAY DEVICE HAVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority from Korean Patent Application No. 10-2015-0108606, filed on Jul. 31, 2015 in the Korean Intellectual Property Office, the disclosure of which are incorporated herein by reference in its entirety.

BACKGROUND

[0002] 1. Field

[0003] Exemplary embodiments relate to a display panel which uses quantum dots for a color filter, and a display device having the display panel.

[0004] 2. Description of the Related Art

[0005] A display device equipped with a display panel for displaying an image is a device which is configured for displaying various formats of image data, such as broadcast signals.

[0006] Display panels may be divided into emissive display panels that are self-luminous and non-emissive display panels that require separate light sources. The emissive display panels include Cathode Ray Tube (CRT) panels, Electro Luminescence (EL) panels, Organic Light Emitting Diode (OLED) panels, Vacuum Fluorescence Display (VFD) panels, Field Emission Display (FED) panels, Plasma Display Panels (PDPs), etc., and the non-emissive display panels include Liquid Crystal Display (LCD) panels.

[0007] A display device that includes the LCD panel further includes a back light unit for emitting light to the rear side of the LCD panel, and the light emitted from the back light unit comes in colors while propagating through color filters included in the LCD panel. In the past, a dye or pigment was used to selectively transmit or block a particular wavelength, but recently, a scheme for filtering light by color conversion using quantum dots has begun being studied and developed.

SUMMARY

[0008] One or more exemplary embodiments provide a display panel and display device having the same within which a low refractive layer is arranged between a quantum dot filter layer and a glass substrate in order to reduce a proportional amount of light that has propagated through the quantum dot filter layer and that is totally reflected at the glass substrate.

[0009] One or more exemplary embodiments also provide a display panel and display device having the same which include partition walls configured to partition the quantum dot filter layer into respective color regions in order to improve efficiency by recycling the light incident to the partition walls.

[0010] In accordance with an aspect of an exemplary embodiment, there is provided a display panel including a quantum dot color filter layer configured to convert a color of light; a transparent front substrate provided at a first side of the quantum dot color filter layer; and a low refractive layer provided between the quantum dot color filter layer and the front substrate, the low refractive layer having a refractive index that is lower than a refractive index of the quantum dot color filter layer.

[0011] The refractive index of the low refractive layer may fall within a range of between 1.0 and 1.4.

[0012] The low refractive layer may include a resin within which nano-particles are distributed, and the nano-particles may include at least one from among titanium dioxide TiO₂ and zinc oxide ZnO.

[0013] The refractive index of the low refractive layer may be lower than a refractive index of the front substrate.

[0014] The refractive index of the front substrate may be higher than the refractive index of the quantum dot color filter layer.

[0015] The light may include blue light, and the display panel may further include a reflective layer provided at a second side of the quantum dot color filter layer that is opposite to the first side of the quantum dot color layer, the reflective layer being configured to transmit blue light therethrough and reflect light that has a wavelength longer than a wavelength of the blue light.

[0016] The display panel may further include an anti-reflective (AR) layer coated on a surface of the front substrate and configured to prevent Fresnel reflection.

[0017] According to an aspect of another exemplary embodiment, there is provided a display panel including: a quantum dot color filter layer including a plurality of converters and partition walls provided between the plurality of converters, each of the plurality of converters including quantum dot particles configured to convert a color of light, and each of the partition walls being configured to absorb light; a front substrate provided at a first side of the quantum dot color filter layer; and reflective walls which surround the partition walls and are configured to reflect light which propagates toward the partition walls.

[0018] Each of the reflective walls may include at least one reflective material from among titanium dioxide (TiO₂), zinc oxide (ZnO), iron oxide (Fe₂O₃), chrome oxide (CrO), cobalt oxide (CoO), stannic oxide (SnO₂), talc, and kaolin (Al₂Si₂O₅(OH)₄).

[0019] The display panel may further include a low refractive layer provided between the quantum dot color filter layer and the front substrate and having a refractive index that is lower than a refractive index of the quantum dot color filter layer.

[0020] The refractive index of the low refractive layer may fall within a range of between 1.0 and 1.4.

[0021] The low refractive layer may include a resin within which nano-particles are distributed, and wherein the nano-particles include at least one from among titanium dioxide TiO₂ and zinc oxide ZnO.

[0022] The refractive index of the low refractive layer may be lower than a refractive index of the front substrate.

[0023] The display panel may further include an anti-reflective (AR) layer coated on a surface of the front substrate and configured to prevent Fresnel reflection.

[0024] According to an aspect of another exemplary embodiment, there is provided a display device including: a back light unit which includes a light source configured to emit light; a quantum dot color filter layer configured to convert a color of light emitted from the light source; a front substrate provided at a first side of the quantum dot color filter layer that is opposite to a second side of the quantum dot color filter at which the back light unit is provided; and a low refractive layer provided between the quantum dot color filter layer and the front substrate, the low refractive